Jordan - Water Infrastructure

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Overview

Identification

COUNTRY
Jordan

EVALUATION TITLE
Water Infrastructure

EVALUATION TYPE
Independent Impact Evaluation

ID NUMBER
DDI-MCC-JOR-SI-WATER-2013-v01.1

Version

VERSION DESCRIPTION
Anonymized dataset for public distribution

Overview

ABSTRACT
Social Impact (SI) has been contracted by the MCC to measure the impact of the Compact activities on economic and social outcomes. This Impact Evaluation (IE) design report lays out how the SI team aims to establish a causal relationship between program interventions and observed changes in household availability and consumption of different sources of water, household income, household expenditure and household health indicators. It also details our strategy for measuring potential impacts on other sectors (agriculture, utility financial performance, and local enterprises) should these occur in parallel to, or instead of, the expected impacts on households. This IE is, to our knowledge, the first attempt to conduct a rigorous IE design of a large infrastructure project in Jordan. It provides a unique opportunity for the MCC, the GOJ, and the broader development community to understand the impact of a large water investment on income and poverty of urban households and others who are affected by it.

The IE will make every possible attempt to measure the impact of the three inter-linked projects separately, in order for MCC to better understand which component(s) of their investment led to specific changes in outcomes. A comparison of the different impacts will further allow for conclusions about the relative cost-effectiveness of each intervention. It must however be noted that because of the complementarities between these different projects, there are very important limitations in the extent to which the IE design will be able to disentangle the separate impacts of the Water Network Project (WNP), the Wastewater Network Project (WWNP), the As-Samra Expansion Project (AEP). Since all three projects are being implemented in Zarqa at the same time, often in overlapping locations, there will be complicated interactions among them which may make it difficult to identify the incremental impacts of each individual intervention. In addition, a significant element contributing to the economic logic of the Compact investments - which we discuss more thoroughly throughout this report - is an assumed water efficiency improvement that would stem from substitution of conventional freshwater currently used in irrigated areas in the Jordan Valley with an expanded supply of treated wastewater collected in Zarqa. The full extent of this assumed substitution effect in fact relies on both the water and wastewater network investments and not on the AEP. It is further assumed that the conventional freshwater saved by this substitution would be made available for higher value uses by municipal and industrial users, thereby improving economic outcomes.

For the purposes of presentation, we have grouped similar and complementary data collection activities into three components, which are described in detail in Section E of this report. This presentation is not intended to imply that any of these three specific components are non-essential; indeed we make the case that all are necessary if the goal is to adequately measure and reduce the risks of misattribution in the overall Compact impact. This point is made following our presentation of the IE logic and a subsequent discussion of the overarching evaluation framework unifying the three components, prior to presenting the details of those components.

Overview of the impact evaluation logic

As emphasized in pre-project feasibility studies and economic analyses of the Compact investments, the economic case for

the MCC investments rests on a complex and interrelated set of hypothesized changes. The linkages between the various components and intermediate and final outcomes, respectively, are depicted in the IE logic shown in Figure ES.1. It is important to note that Figure ES.1 does not directly follow the categorization of impacts promulgated in previous descriptions of Compact impacts (e.g. accompanying the MCC's economic rate of return analysis), for the following main reasons:

1) The impacts included in those analyses were admittedly non-exhaustive, due to data limitations in quantifying them. (For example, effects on enterprises and/or on property values were omitted from the analyses - see Section D of this report.)

2) The purposes of the IE logic are a) to trace the relationships between projects, intermediate outputs, and final outcomes, b) to illustrate the overlapping relationships between project activities and desired outcomes, and c) to draw attention to the underlying assumptions.

The IE logic aims to identify the set of final outcomes (and to a lesser extent the intermediate outputs) we intend to measure and track through our IE design. Importantly, the so-called primary substitution effect (the increased use of blended KTR water in irrigation in the place of freshwater) is not and cannot be measured or shown as a single outcome. Rather, the quantification of this possible benefit stems from analysis that integrates several outcomes and outputs - to be carried out at the conclusion of the IE using data we proposed to collect - that flow through the following connections: a) reduced physical losses (WNP) and b) increased wastewater capture (WNP and WWNP); which lead to c) increased wastewater use in agriculture and d) substitution of King Talal Reservoir (KTR) water for King Abdullah Canal (KAC) water in the Jordan Valley; which together e) change per-capita use of utility water and lead to f) end-user time savings; g) consumer cost savings; h) aesthetic and health benefits; and i) are capitalized in land values. Similarly, understanding the net value of the secondary substitution effect, or the increased use of network water in place of tanker and/or vended water, flows through a complex chain that includes (not in order of importance), a) improved water quality at the point of delivery and b) changes in per capita use of utility water (due to the factors listed above as well as these quality improvements) which are embedded in reduced purchase of c) tanker water and d) vended water; both of which should ultimately appear as consumer e) cost and f) time savings, but may also result in reduced sales and/or profits in the water tanker and vended water industries. In addition, the extent of these primary and secondary substitution effects will likely be mediated (positively or negatively) by changes in utility performance, itself a function of the delivery of improved services.

EVALUATION METHODOLOGY
Propensity Score Matching

UNITS OF ANALYSIS
Households, enterprises, individuals (farmers)

KIND OF DATA
Sample survey data [ssd]

TOPICS

Topic	Vocabulary	URI
Water, Sanitation and Hygiene	MCC Sector	
Gender	MCC Sector	

KEYWORDS
Jordan, Water, Water, Sanitation, and Hygiene, Impact Evaluation, Propensity Score Matching, Wastewater, Agriculture, Willingness to Pay

Coverage

GEOGRAPHIC COVERAGE
Urban areas (specifically, Zarqa Governorate) and the Jordan Valley

UNIVERSE
Households and enterprises located in Zarqa (with comparison groups in Amman), as well as farmers near the As-Samra Wastewater Treatment Plant, along the Zarqa River above the King Talal Dam, and farmers in the Middle and Southern portions of the North Directorate of the Jordan Valley.

Producers and Sponsors

PRIMARY INVESTIGATOR(S)

Name	Affiliation
Social Impact	

FUNDING

Name	Abbreviation	Role
Millennium Challenge Corporation	MCC	

Metadata Production

METADATA PRODUCED BY

Name	Abbreviation	Affiliation	Role
Millennium Challenge Corporation	MCC		Review of Metadata
Social Impact	SI		Independent Evaluator

DATE OF METADATA PRODUCTION
2014-09-29

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MCC Compact and Program

COMPACT OR THRESHOLD
Jordan Compact

PROGRAM
The Millennium Challenge Corporation (MCC) signed a five-year, $275 million Compact with the Government of Jordan (GOJ) to reduce poverty and increase income in Zarqa Governorate through increases in the supply of water available to households and enterprises through improvements in the efficiency of water delivery, the extension of wastewater collection, and the expansion of wastewater treatment. The Compact entered into force in December 2011, commencing the five-year implementation period scheduled to end in December 2016.

MCC SECTOR
Water, Sanitation and Hygiene (WASH)

PROGRAM LOGIC
The MCC Jordan Compact includes three inter-linked projects: (i) The Water Network Project (WNP) consists of two activities, a) the rehabilitation and restructuring of water supply transmission and distribution infrastructure, and replacement of domestic water meters, with the aim of improving the overall water system efficiency, reducing water losses and facilitating the transition from periodic distribution under high pressure to more consistent, gravity-fed distribution; and b) the Water Smart Homes (WSH) activity, a household-level intervention aimed at improving in-house water storage and sanitation that consists of a general outreach campaign, as well as delivery of infrastructure subsidies and technical assistance to poor households. (ii) The Wastewater Network Project (WWNP) encompasses the expansion, rehabilitation and reinforcement of the wastewater network in West and East Zarqa, as well as West Ruseifa, aimed at improving the overall wastewater system efficiency and expanding the capture of municipal wastewater for reuse in agriculture downstream, possibly making additional freshwater available to the population of Zarqa Governorate through future wastewater substitutions for conventional freshwater.. (iii) The As-Samra Expansion Project (AEP) is designed to raise the capacity of the existing treatment plant with the aim of providing proper handling of increased volumes and loads of both oxygen-demanding material and suspended solids, allowing treatment of the additional wastewater volumes resulting from the WNP and WWNP investments.

PROGRAM PARTICIPANTS
Households and enterprises located in Zarqa (with control groups in Amman), as well as farmers near the As-Samra

Wastewater Treatment Plant, along the Zarqa River above the King Talal Dam, and farmers in the Middle and Southern portions of the North Directorate of the Jordan Valley.

Sampling

Study Population

Households and enterprises located in Zarqa (with comparison groups in Amman), as well as farmers near the As-Samra Wastewater Treatment Plant, along the Zarqa River above the King Talal Dam, and farmers in the Middle and Southern portions of the North Directorate of the Jordan Valley.

Sampling Procedure

IE Component 1: Evaluation of Water and Wastewater Network Project Impacts in Zarqa

To measure effects on households and enterprises, we propose to implement ordinary or generalized propensity score matching (PSM) in combination with difference-in-differences (DiD) and regression analysis. PSM will be used to predict selection into the various treatment groups using pre-intervention characteristics of those areas. We will then match areas that have similar propensity scores (i.e., that appear equally likely to have received specific exposures to the intervention, based on observable characteristics) to ensure comparability across controls and differentially treated areas, and conduct subsequent balance tests. The DiD design will, in turn, allow us to reduce the threats posed by unobservable differences between affected units that do not vary over time. Next, regression analysis will further allow us to control for factors other than treatment status that may be related to outcomes, thereby increasing precision of treatment estimates as well as indicating whether the quasi-experimental control achieved by the matching approach was successful (and adjusting them to the extent possible). Finally, in an effort to address the issue of spillovers, we will aim to include control areas outside of the Zarqa water and wastewater network, for example areas in Amman that are nearest to Zarqa,

The household survey power calculations show that a sample size of 3,440 randomly-selected households would provide sufficient power to detect statistically significant changes of 10% magnitude on six important outcome variables, including water supply, water consumption, water bills, spending on treatment shop water, quantity of water purchased in treatment shops, and monthly expenditures on water. To be clear, the calculations assume that:
·A sample size of 2,500 would be sufficient for detecting 10% differences across treatment and control groups if the sample is comprised of 4 groups (roughly 625 households per group)
·We add 1 additional group from peri-urban zones in Amman to test for Zarqa-wide spillovers (625 households, 3125 total)
·There will be 10% attrition, such that 313 additional households are required (total of about 3,440).

For the enterprise survey, we suggest a minimum sample of approximately 400 enterprises selected from two sources: a) frequently visited enterprises as reported from the above household survey, and b) enterprises from a DoS national workforce survey. However, it is noted that the sample size for the enterprise survey will be reassessed following baseline, which will allow more detailed power calculations, and consideration of whether more careful stratification by formal/informal status would be warranted.

Component 2: MCC Compact impacts on agriculture downstream of As-Samra and in the Jordan Valley

For the purposes of baseline agricultural survey data collection, we plan to survey roughly 550 farmers (110 farmers in each of five differentially affected areas) to determine crop production and returns for the previous year, along with measures of water supply from different sources. Using the data from these 550 farms, we will conduct more detailed power calculations to determine the appropriate sample size for annual tracking of the balance of water sources, production, and net profits at regular and more frequent (e.g. quarterly) intervals. It is our understanding that metering is very limited in the Jordan Valley, so we will rely on self-reports of water consumption and third-party ground-truthing from the JVA and other sources. More detailed power calculations can be provide upon gaining access to data on the variability of crop productivity and net returns in different parts of Jordan.

Questionnaires

Overview

This impact evaluation includes three separate questionnaires, translated from English to Arabic:

Household-level surveys will collect information on household demographics; water sourcing (including network, tanker and shop water), pumping, storage, and use behaviors; preferences and satisfaction with water supply and sewer service; water quality measured at the tap and in in-house storage containers (chlorine residual, salinity, turbidity, and E. coli or thermo-tolerant coliform counts); coping and health costs related to intermittent water supply and poor water quality; and expenditures (as recorded in water bills, as well as on other household items), income, and other socio-economic characteristics.

Enterprise surveys will focus on enterprise characteristics, production inputs and outputs, costs and revenues, and assess constraints with regards to using water as an input to production. In addition, for assessing impacts on Zarqa's important informal sector (for which no sampling frame currently exists), we will rely on the informal production activities carried out by households selected into our sample, supplemented by a snowball approach that begins with referrals by sample households to “businesses” (both formal and informal) that they use in their neighborhood.

Agricultural surveys will include questions on farmer characteristics (education, training, knowledge, relative influence, risk preferences, etc.), farm attributes (soils, canal location, etc.), farm equipment and use of advanced technology, inputs and production, animal husbandry, prices of agricultural products, and farm and non-farm sources of income.

All survey instruments undergo forward and backward translation prior to rigorous pre-testing.

Data Collection

Data Collection Dates

Start	End	Cycle
2014-04-13	2014-05-18	Household Survey Baseline
2014-11	2014-12	Enterprise Survey Baseline

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Data Collectors

Name	Abbreviation	Affiliation
Jordanian Department of Statistics	DoS	

Data Processing

No content available

Data Appraisal

No content available